

User Manual For DC Series MX06 60A Shelf

DC MX06 60A Shelf



The DC Series MX06 60A Shelf is a 19" compatible modular power plant capable of supplying up to 63A at -48V DC (54V). The unit contains a simple alarms/control card that can configure up to 6 x 10.5A rectifiers and offers voltage control and basic alarms. Optional mounting brackets are offered to allow the system to be fitted in a 23" rack. Easy sub-assembly access and replacement allows for convenient and efficient maintenance.

Applications

- Cellular and PCS
- Distributed Networks
- PABX
- Customer premises
- Industrial
- Microwave
- Broadband Wireless
- Fibre

Features

- Hot Pluggable Fan Cooled Units
- Form C relay signals and visual alarms
- Single or 3-phase versions available with a wide Input voltage range
- Battery temperature compensation of charging voltage
- Overvoltage and reverse voltage protection
- 3600W Output Power

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Issue Record

ISSUE	DESCRIPTION	DATE	APPROVED
REV01	New document	7 th JAN 2002	YES
REV02	Update	18 th FEB 2002	YES

1 General Information

1.1 Introduction

DC Power Plants from APC have unique features that make them easy to install, maintain, and upgrade. The rectifier units are modular and truly “hot-pluggable” into the shelf assembly without any separate ac wiring.

All system settings are controlled from the system control unit that provides monitoring and control functions for each component of the system as well as alarm outputs for system diagnosis and maintenance.

The APC international network of sales and service offices and qualified representatives provides sales assistance for proposals, purchases, and after-sales support.

1.2 Safety Precautions

The unit must be installed into an enclosure which conforms to the requirements of EN60950 : 2000, CAN/CSA 22.2 # 60950-00, UL60950 3rd Edition and be connected to comply with the standard. This includes but is not limited to providing external disconnection devices.

The end use equipment must be installed in accordance with the local building code and practices, by proper licensed installation personnel, taking into consideration all cautions and requirements detailed in this manual.

For proper guidance on the selection of any external disconnects and cabling requirements see the CEC and NEC codes or the local electrical code of the country of installation.

Before using the power system, carry out the following:

1.2.1 READ AND FOLLOW THE SAFETY PROCEDURES.

1.2.2 REFER TO THE FOLLOWING DOCUMENTS. ALL PROCEDURES MUST BE CARRIED OUT IN ACCORDANCE WITH THE INSTRUCTIONS THEREIN.

- EN60950 : 2000, CAN/CSA 22.2 # 60950-00, UL60950 Third Edition.
- MANUFACTURER'S INSTRUCTIONS
- MATERIAL SAFETY DATA SHEET (MSDS) FOR THE BATTERY
(If batteries are supplied with the system)
- HEALTH AND SAFETY AT WORK ACT, 1974 (UK)
- OCCUPATIONAL SAFETY & HEALTH STANDARDS (OHSA) (USA)
- ELECTRICITY AT WORK ACT, 1989 (UK)
- NFPA 70 NATIONAL ELECTRICAL CODE (USA)

- CEC Code C22.1-98 (Canada)
- CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH (COSHH) REGS
- MANUAL HANDLING REGULATIONS, 1993 (See Section 6)

1.2.3 BECOME FAMILIAR WITH THE HAZARDS ASSOCIATED WITH THE POWER SYSTEM AS DETAILED IN PARA 2.

1.2.4 CAUTION - BEFORE INSTALLING RECTIFIERS (POWER SUPPLIES) INTO AN UNPOPULATED SYSTEM SEE INSTALLATION INSTRUCTIONS IN SECTION 4.

1.3 Types of Hazards

The following hazards are present in the power system:

- ELECTRICAL VOLTAGE
- ELECTRICAL ENERGY
- HEAVY MASS

POTENTIALLY LETHAL VOLTAGES AND SOURCES OF HIGH ENERGY ARE PRESENT WITHIN THE POWER SYSTEM. EXTREME CAUTION MUST BE OBSERVED AT ALL TIMES. ACCESS TO THE INTERIOR OF THE SYSTEM FOR INSTALLATION, COMMISSIONING, MAINTENANCE AND REMOVAL AND REPLACEMENT PURPOSES IS LIMITED TO FULLY TRAINED SERVICE PERSONNEL ONLY. THIS SHOULD BE DONE WITH ALL POWER SOURCES DISCONNECTED EXCEPT WHEN ABSOLUTELY NECESSARY.

1.4 Inspection upon Receipt of Goods

1.4.1 General

APC has taken precautions in packing the power equipment for shipment to ensure its safe arrival; however, the entire shipment including any boxes or crates should be inspected upon receipt for evidence of damage that may have occurred during transit.

1.4.2 Visible External Damage

It is the responsibility of the person receiving the shipment to inventory and inspect all materials against the bill of lading or waybill provided IMMEDIATELY upon taking delivery while the carrier representative is still on site. Please be sure that all items are accounted for, including the correct number of pallets and the quantity of accessory and/or component boxes. Also, note any visible external damage that may have occurred during transit.

If damage has occurred or the quantity of items is not correct, then:

- 1) Make a descriptive notation on the delivery receipt before signing.
- 2) File a damage or shortage report with the carrier that delivered the shipment.

1.4.3 Concealed Damage

It is the customer's responsibility to unpack the power system and equipment received from APC and check for concealed damage. Within 15 days of receipt, check the materials received against the detailed packing list to verify that the quantity and condition are complete and satisfactory.

Again, note any damage to the internal packing material and/or material shortages. If damage or shortage is noted, then:

- 3) Request an inspection by the carrier
- 4) File a concealed damage claim; and/or
- 5) File a material shortage claim with your APC representative.

DELAY IN NOTIFYING THE CARRIER MAY RESULT IN LOSS OF RIGHT TO REIMBURSEMENT FOR DAMAGES OR LOSS.

If you are unsure about the appearance of a part while conducting the materials inventory and inspection, refer to the manual or contact the Customer Service Department of APC.

Should you have any questions concerning potential damages or should you experience a lack of cooperation from your carrier, please contact your APC representative, or call APC.

1.4.4 Return of Damaged Goods

Should equipment be damaged and require return to APC for repair, the APC service representative will provide instructions along with a valid returned material authorization (RMA) number to facilitate return of the damaged goods to the APC repair center.

It is important that the steps outlined in Section 1.4.2 and also Section 4 and 5 are followed carefully. Your APC representative will assist you, if required, in obtaining proper disposition of an initial delivery return issue; however, a valid RMA number must be obtained before returning any equipment to APC.

1.5 APC Worldwide Customer Support

Customer support for this or any other American Power Conversion (APC) product is available at no charge in any of the following ways:

- Visit the APC web site to find answers to frequently asked questions (FAQs), to access documents in the APC Knowledge Base, and to submit customer support requests.

<http://www.apc.com> (Corporate Headquarters)

Connect by links to APC web pages for specific countries and regions, each of which provides customer support information.

<http://www.apc.com/support/>

Submit customer support requests.

- Contact an APC Customer Support centre by telephone or email.

Regional Centres:

APC Headquarters (US and Canada)	(1) (800) 800 4272 (toll free) apctech@apcc.com
Latin America	(1) (401) 789 5735 (United States) apctchla@apcc.com
Europe, Middle East, Africa	(353) 91 702020 (Ireland) apceurtech@apc.com

Local, country-specific centers: go to <http://www.apc.com/support/contact> for contact information.

Contact the APC representative or other distributor from whom you purchased your APC product for information on how to obtain local customer support.

1.6 Warranty Information

1.6.1 Limited Warranty

American Power Conversion (APC) warrants the DC Series MX06 60A Shelf to be free from defects in materials and workmanship for a period of two years from the date of purchase. It's obligation under this warranty is limited to repairing or replacing, at it's own sole option, any such defective products. This warranty does not apply to equipment that has been damaged by accident, negligence, or misapplication or has been altered or modified in any way. This warranty applies only to the original purchaser.

1.6.2 Warranty Limitations

Except as provided herein, American Power Conversion makes no warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

Some jurisdictions do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

Except as provided above, in no event will APC be liable for direct, indirect, special, incidental, or consequential damages arising out of the use of this product, even if advised of the possibility of such damage.

Specifically, APC is not liable for any costs, such as lost profits or revenue, loss of equipment, loss of use of equipment, loss of software, loss of data, costs of substitutes, claims by third parties, or otherwise. This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.

2 Product Overview and Technical Description

2.1 Specification

2.1.1 Rectifier

Parameter (per rectifier)	1TWF0500H54**
Approved Input Rating	115V or 230Vac
I/p Operating Range	103.5V to 264V
RMS Input Current	6.5A max @115V
“ “ “	3.6A max @230V
Approved Input Frequency range	45 – 65Hz
Turn-on Surge	< 10A
Turn-on Time	< 2 Seconds
Internal Fuse	7 amp 250V time lag
Power Factor	99 % typical, 90 % min
Output Voltage (Nominal)	54.5V dc
O/p Current (Rated)	10.5A @ 230V, 0-50°C 9A @ 230V, 50-65°C 9A @ 115V, 0-50°C 8A @ 115V, 50-65°C
Current Limit	105 % of rated
Over Volts Protection	59.5V dc $\pm$ 0.5V
Power O/p (Rated)	500W @ 115V 600W @ 230V
Efficiency	83 % typical
Cooling	Fan Cooled, front to rear
Ambient Temp	-40 to 50°C (de-rate above 50°C)

Note :- See TWF0500 Rectifier datasheet for further or more detailed information

2.1.2 System AC Input

Input Voltage (Single phase)	90 - 264Vac (Live to Neutral)
(3 Phase Star)	208Vac, 380Vac, 400Vac or 415Vac (phase to phase)
(3 Phase Delta)	208Vac only (phase to phase)
RMS Current (max) single phase	39A @ 115V $\pm$ 10%, 22A @ 230V $\pm$ 10% (total)
RMS Current (max) 3 phase star	13A @ 208Vac, 7.2A @ 415Vac (per phase)
RMS Current (max) 3 phase delta	12.5A @ 208Vac (per phase)
Frequency	45 – 65 Hz
Efficiency	83% Typical
Harmonic Distortion	Complies with EN61000-3-2

2.1.3 System Output

Output Voltage Nominal	54.5Vdc
Voltage Adjustment Range	44 V – 57 V
Current Rating	63 A @ 230Vac, 54 A @ 115Vac, 42A @ 100Vac
Temperature Coefficient	-76mV/°C ±10% (over range 0°C - 50°C)
Current Limit	100% - 110% of Rated Current
Reverse Quiescent Current	Less than 100mA, Typically 50mA
Regulation	250mV max for any line or load condition
Over voltage	59.5V ± 0.5V (reset by interruption of AC Input)

2.1.4 Environmental

Temperature Range	-25°C to 65°C operating range (De-rate above 50°C) See section output current ratings section 2.1.1 for per rectifier de-rating detail
Humidity	85% non condensing

2.1.5 Safety Approvals

Approved to the following	CE marked to the European Low Voltage Directive 73/23/EEC amended by 93/68/EEC complies with BS EN60950:2000
	Certified to CAN/CSA 22.2#950-00 (NRTL/C UL1950 3rd Edition)

2.2 LED's

2.2.1 4 LED Rectifier

Rectifier LED's	Input Healthy	Green
	Output Healthy	Green
	Current Limit	Red
	Overvoltage	Red

2.2.2 Single LED Rectifier

Rectifier LED	Rectifier Fail	Red
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NB/ LED's are lit when description is true.

2.3 Alarms + Customer Inputs

To monitor the system status a selection of alarm outputs are available. Each rectifier has 4 front panel LED's giving a visual notification of a system fault. There is also a range of open collector transistor alarm outputs and a set of form C relay contacts that can be accessed at the rear of the shelf.

Below is a list of the available alarms along with their function and pin number.

2.3.1 System Alarms/Inputs

All the system alarms are available from the 26way ribbon connector (SK4) mounted on the alarms card. The alarms and inputs are listed below.

Alarm/Input	Pin	Description
V Trim	SK4-13	This pin floats at 2.5V (O/P @ 54.5V) nominal with respect to negative sense (SK4-15). Applying a DC voltage adjusts the output by $-1V/V$. (For 1V swing on program pin the output voltage changes by $-1V$)
+ Sense	SK4-17	Bussed through sense pins from rectifiers.
- Sense	SK4-15	Bussed through sense pins from rectifiers.
Rectifier Fail	SK4-11	N/C relay contact bussed through from rectifier. Contact is closed on fail
AC Input Fail	SK4-24	Relay contact on daughter board. Contact closed when input supply fails.
AC Input Healthy	SK4-8	Relay contact on daughter board. Contact closed when input healthy.
Common	SK4-10	Common for all signals (unless stated otherwise). Signal common and relay commons connected together
Enable	SK4-19	Connects to SK29-2 (back-plane). To enable system output either fit link from SK29-2 to SK29-3 (-Ve O/p) or connect SK4-19 (enable) to SK4-15 (-Ve Sense)
5V	SK4-18	From internal rectifier rail. Low current capability supply to be connected to Vtrim, to program down output volts.
Current Share	SK4-12	Use for paralleling purposes only
Fan Fail	SK4-9, SK4-1	Opto isolated open collector transistor output (rated at 60Vdc @20mA). Pulls low when one or more rectifier fans fail (not available if system fitted with Single LED Rectifiers).

The relay contacts are rated as follows:

AC Rating	-	0.5A @ 125Vac
DC Rating	-	1A @ 24Vdc
Max VDC	-	0.6A @ 110Vdc

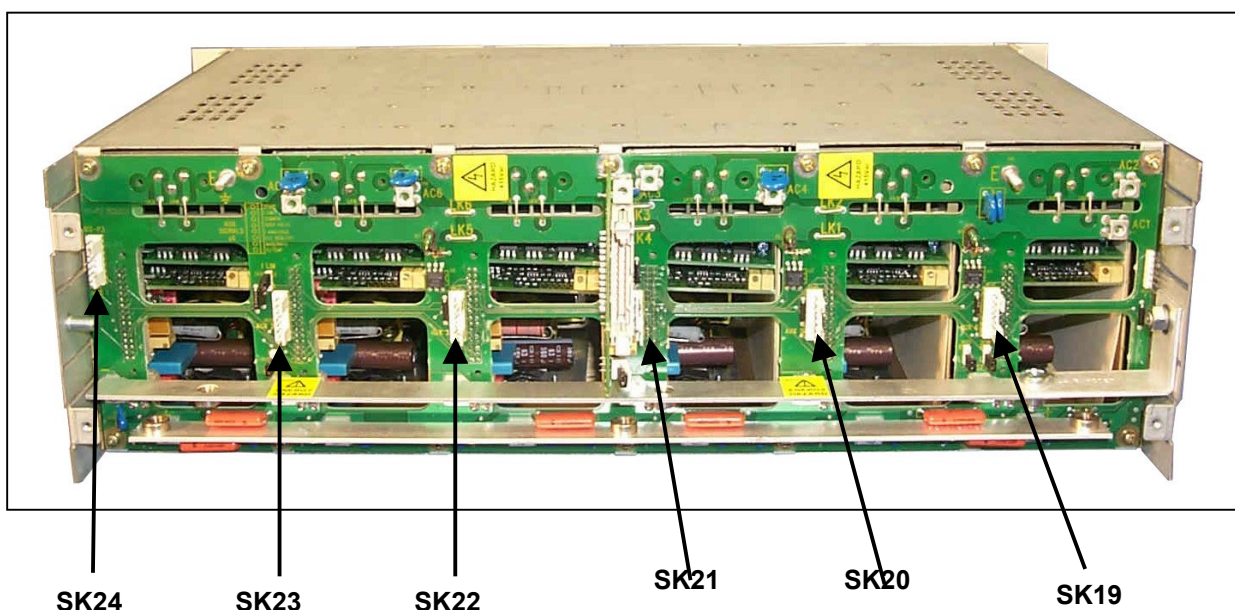


2.3.2 Individual Rectifier Alarms

In addition to the system alarms and inputs, six alarm connectors are mounted on the backplane board. Each one of these connectors offers six alarms/inputs for a particular rectifier. This means the end user can, if required, monitor each rectifier fitted separately as well as the system as a whole.

SK19 = Rectifier 1 SK22 = Rectifier 4
SK20 = Rectifier 2 SK23 = Rectifier 5
SK21 = Rectifier 3 SK24 = Rectifier 6

Alarm	All Sockets	Description
Over Temp	Pin 1	Open collector opto output is pulled low when unit has shut down due to over temp conditions. Alarm has 20mA current capability (not available if system fitted with Single LED Rectifiers).
Marginate	Pin 2	Link the marginate pin to +Ve output or +Ve Sense to reduce the output voltage by 2.4V. When link removed the output will return to nominal.
D.C Healthy	Pin 3	Opto signal is open collector pulled low when output healthy (31V-60V). Current capability is 20mA
I Analogue	Pin 4	This is an analogue voltage proportional to output current. Full load (10.5A) is represented by a voltage of 5Vdc
Over Volts	Pin 5	Open collector opto output pulled low when output trips due to over volts. Has a 20mA current capability (not available if system fitted with Single LED Rectifiers).
Common	Pin 6	Reference point for all of the alarms
Current Limit	Pin 7	Open collector opto output pulled low when in current limit. Has a 20mA current capability (not available if system fitted with Single LED Rectifiers).



2.4 System Set-up options

2.4.1 Current Limit Programming

The system output current limit can be set to either the standard “High” (100%) level or “Low” (70%) level by using **SK30**.

For “High” current limit level link pins 1 and 2

For “Low” current limit level link pins 2 and 3

Selecting “Low” current limit level will program down each rectifiers current limit level to roughly 70% of the default level. (See section 2.1.1 for default levels).

System is set to “High” current limit as standard.

2.4.2 Enable Function

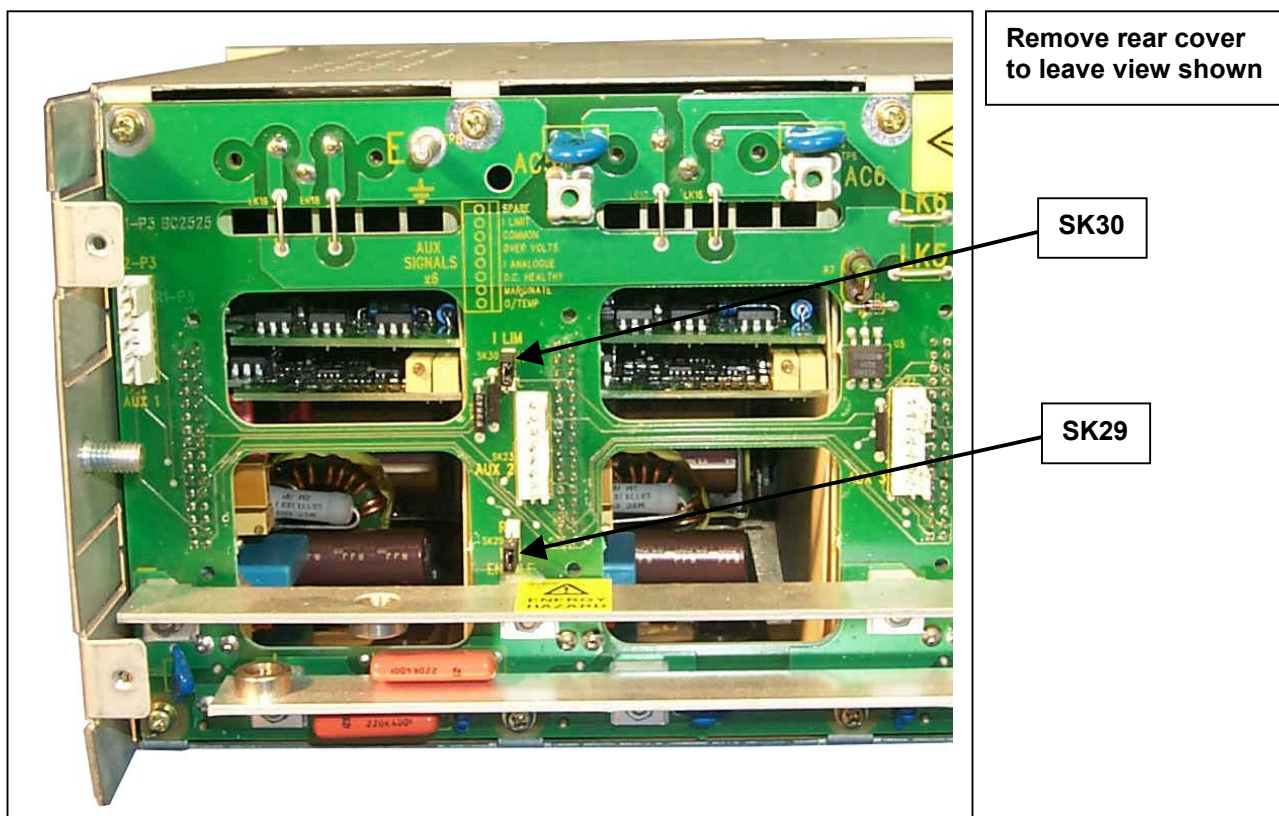
The system can be set to either “Local” or “Remote” Enable by using **SK29**.

For “Local” enable link SK29 pins 2 and 3 with supplied link.

For “Remote” enable link SK29 pins 1 and 2 with supplied link.

If “Remote” enable SK4-19 and SK4-10 must be linked to enable rectifier outputs.

System is set to “Local Enable” as standard.



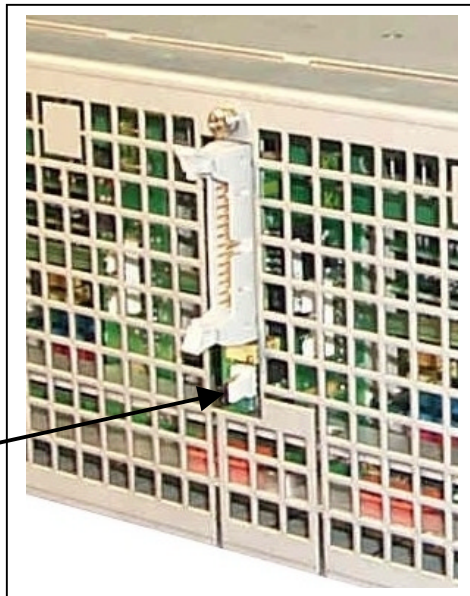
2.4.3 Temperature Compensation

Temperature compensation / Fixed output voltage selection (SK1)

For "Fixed Output Voltage" SK1-1 to SK1-2 will be linked. (default setting)

For "Temp Comp" remove above mentioned link and fit supplied thermistor kit to SK1.

Temperature compensation uses the thermistor to monitor battery temperature and automatically adjusts the output voltage of the system. This ensures the charging voltage stays within the battery manufacturers recommended limits.

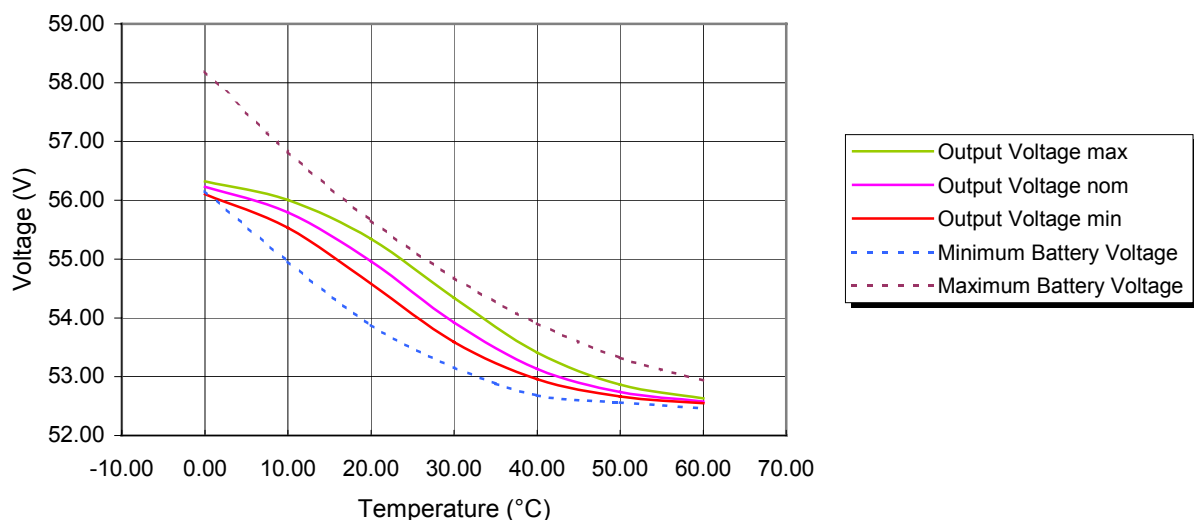


- SK1**
- Pin 3
 - Pin 2
 - Pin 1

If temperature compensation is enabled the output will be as follows:

Nominal Output: 54.5Vdc @ 25°C
Temp coefficient: -76mV/°C ±10%

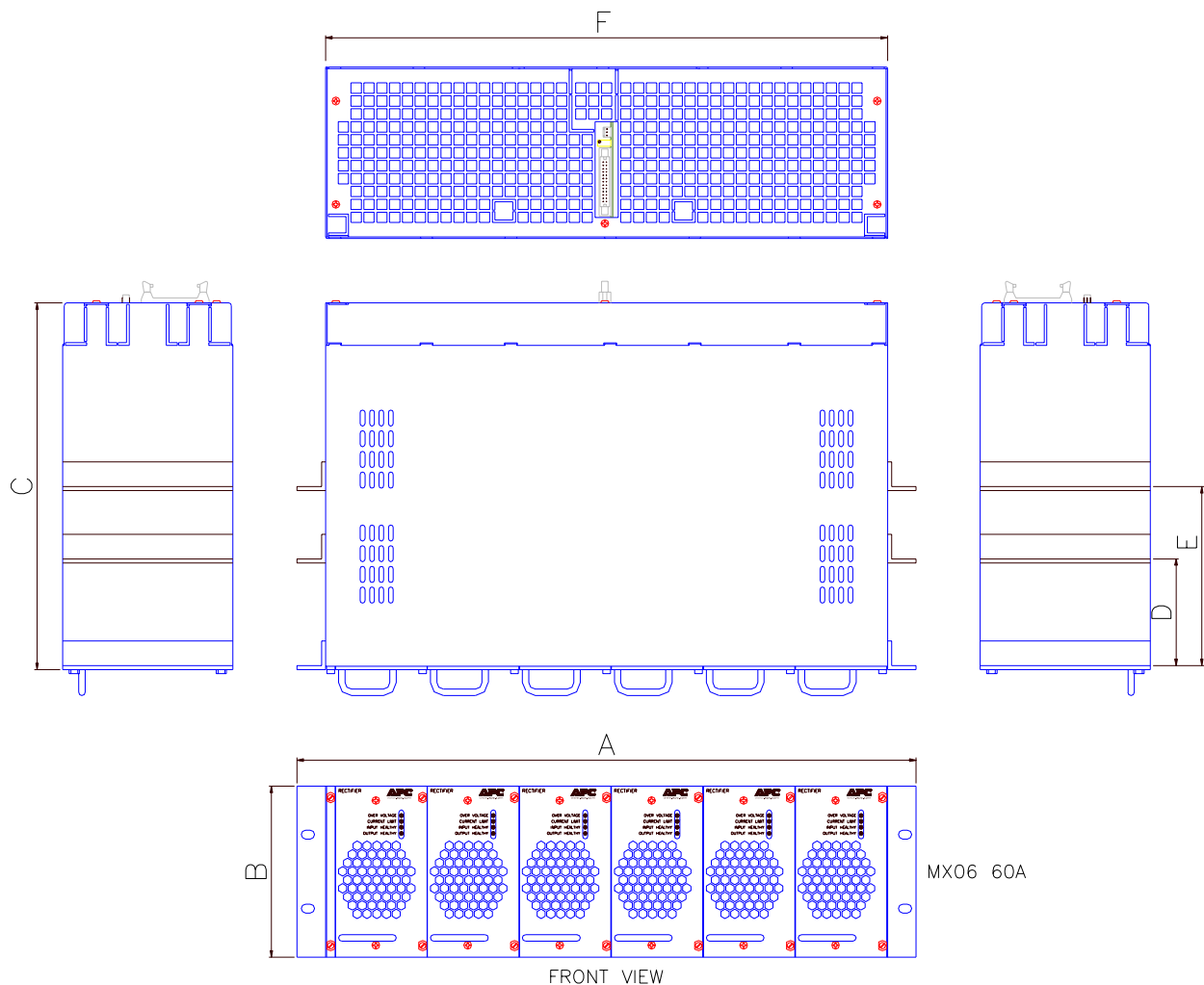
DC MX06 60A Calculated Temperature Compensation (54V)



2.5 Mechanical

2.5.1 Dimensions

Dimension	A	B	C	D	E	F
Length	482.6mm (19in)	132.5mm (5.22in, 3U)	283.6mm (11.17in)	82.5mm (3.25in)	138.5mm (5.45in)	438.2mm (17.25in)



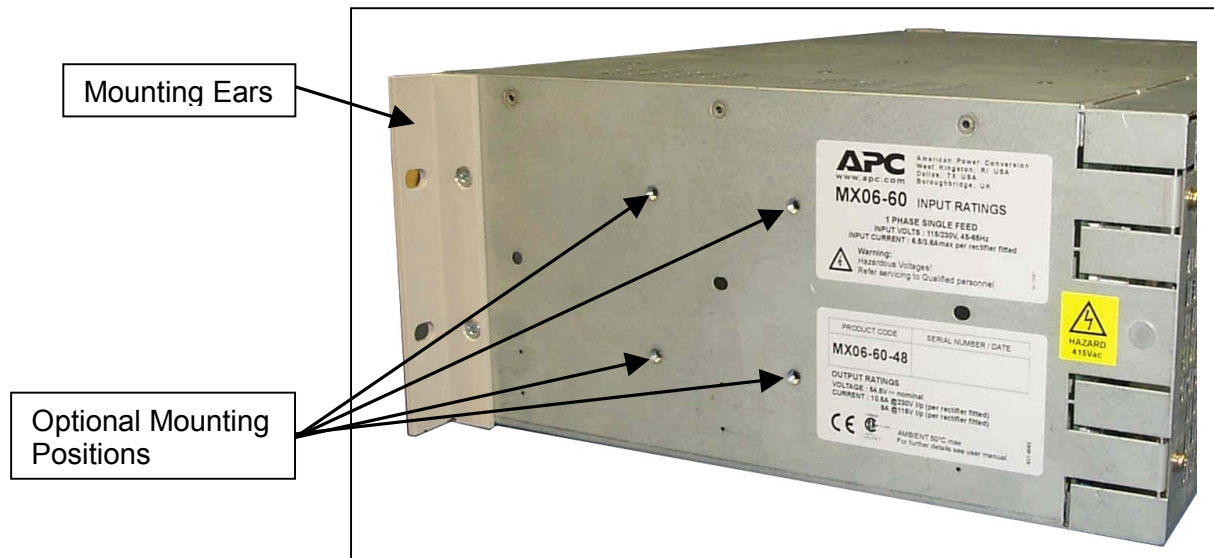
2.5.2 Weight

Item Measured	Empty Shelf	Single Rectifier	Full System
Weight (Kg)	5.2	1.75	15.70
Weight (lbs)	11.5	3.85	34.55

2.5.3 Mounting Options

The DC MX06 60A Shelf has 3 positions for mounting ears. If mounting ears were ordered with the system they will be fitted in the front position as standard. The 2 alternative mounting positions are shown below. The end user can simply unscrew the ears and re-fit in the desired position.

Ensure all screws are re-tightened sufficiently.



3 System Configuration

The MX06 60A shelf is designed to meet a range of customer requirements/applications. A number of options are available including alternative input supply configurations, 19 and 23 inch mounting versions and temperature probes etc.

Contact APC for details.

Alternatively the following pre configured system is available:

DCM00K04W481

Rear access 60A system with a single phase–single feed input configuration including alarms card, 19" mounting brackets, 4 rectifier blanking panels and a non-temperature compensated output voltage of 54.5Vdc. Probe for temperature compensation supplied.

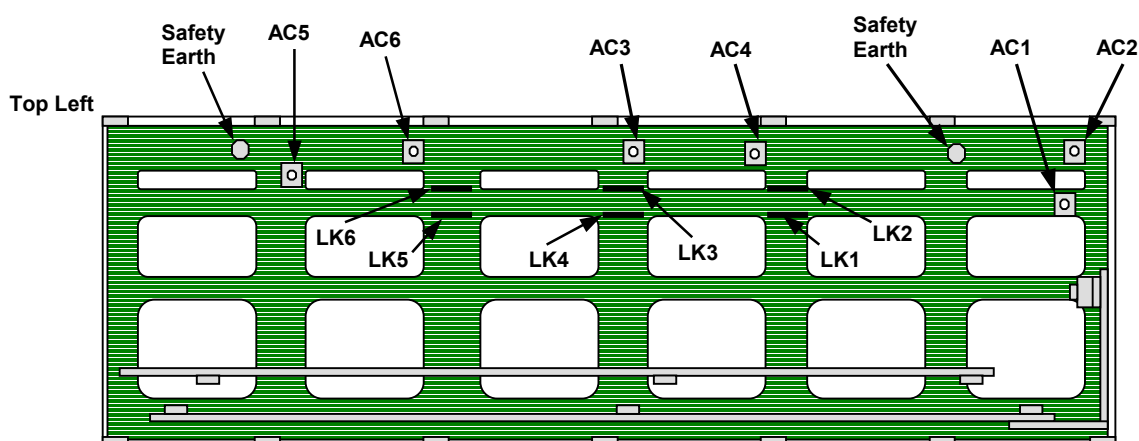
4 Installation Procedure

4.1 AC Primary Input

4.1.1 Single Phase, Single Feed

To connect the input supply to the DC MX06 60A Shelf proceed as follows:

- The AC input current to the system should be limited by an appropriate device in the event of a short circuit as defined in **EN60950** to protect the internal wiring of the end use equipment. Maximum input current is 39A at 115Vac and 22A at 230Vac, the device should be rated accordingly.
- AC Input cabling used should meet all local regulations and be colour coded as required for country/state concerned. This should be rated at 22A for 230V input and 39A for 115V input.
- Ensure that the AC supply intended for connection is isolated, locked off and under single operator control. Remove the rear cover to leave the view as shown below
- Connect as follows:
 - Earth to either earth stud (connect first)
 - AC1 (Live), AC2 (Neutral)
 - or AC3 (Live), AC4 (Neutral)
 - or AC5 (Live), AC6 (Neutral)
- Connection can be made to any of the 3 pairs of input terminals detailed above but to optimise EMC performance use the nearest safety earth stud and route cables close to the top of the shelf using the supplied routing clips (see section 4.4 for cable routing details)
- The cables should exit through one of the top knockout tabs but if an alternative knockout is to be used ensure additional insulation is used where cabling passes over secondary parts.

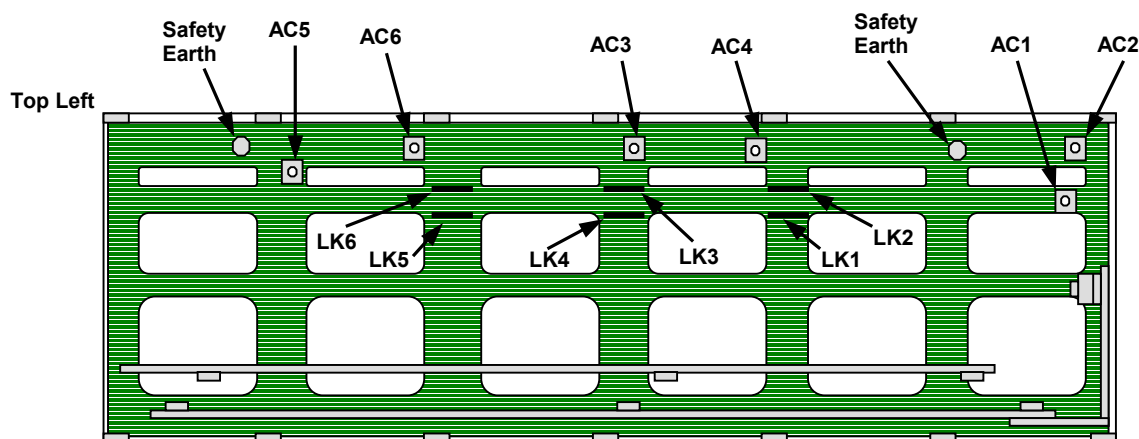


- Connect the cables terminated with M4 ring crimps using the M4 x 8 screws (M4 flange nut for earth connection) supplied in the accessory kit
- Refer to section 5 entitled "Commissioning the system" before applying AC power.

4.1.2 Single Phase, AB Feed

To connect the input supply to the DC MX06 60A Shelf proceed as follows:

- The AC input current to the system should be limited by an appropriate device in the event of a short circuit as defined in **EN60950** to protect the internal wiring of the end use equipment. Maximum input current is 20A per feed at 115Vac and 11A per feed at 230Vac, the device(s) should be rated accordingly.
- AC Input cabling used should meet all local regulations and be colour coded as required for country/state concerned. This should be rated at 11A for 230V input and 20A for 115V input.
- Ensure that the AC supply intended for connection is isolated, locked off and under single operator control. Remove the rear cover to leave the view as shown below
- The main circuit board should have been configured for single phase AB feed use, by removing LK3 and LK4. This is normally factory configured.
- First the two safety earth connections should be connected to the studs labelled below.
- Feed **A** should be wired to: AC1 (Live) and AC2 (Neutral)
- Feed **B** should be wired to: AC5 (Live), AC6 (Neutral)
- Connect the cables terminated with M4 ring crimps using the M4 x 8 screws (M4 flange nut for earth connection) supplied in the accessory kit.



- The cables should exit through one of the top knockout tabs but if an alternative knockout is to be used ensure additional insulation is used where cabling passes over secondary parts. Cables should be routed close to the top of the shelf using the supplied routing clips (see section 4.4 for further details)
- Refer to section 5 entitled "Commissioning the system" before applying AC power.

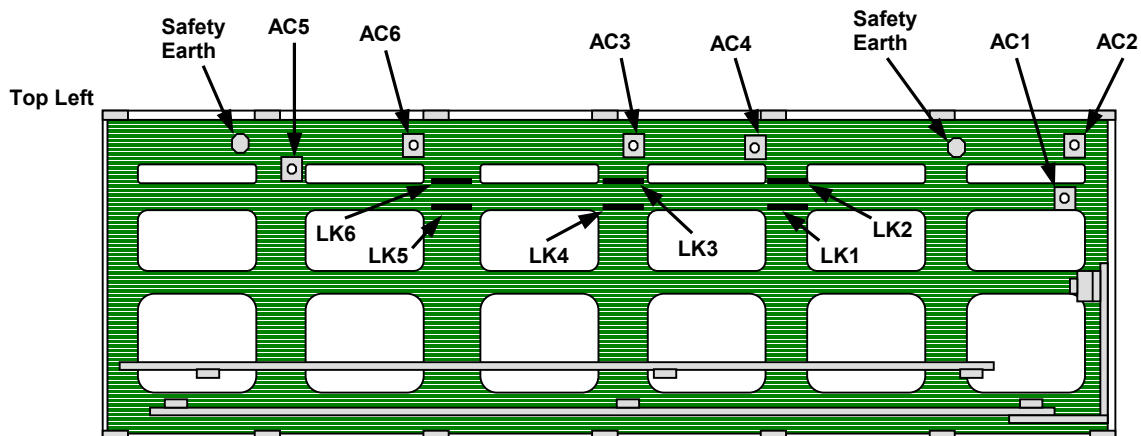
4.1.3 3 Phase Star Supply

The DC MX06 60A Shelf can be used on any of the following supplies: 415V, 400V, 380V or 208V phase to phase.

The maximum input current is 39A on a 208Vac phase to phase supply and 22A on a 380Vac, 400Vac or 415Vac supply. Choose AC Input cabling rated accordingly and colour coded as required for country/state concerned.

To connect the input supply to the DC MX06 60A Shelf proceed as follows:

- The AC input current to the system should be limited by an appropriate device in the event of a short circuit as defined in **EN60950** to protect the internal wiring of the end use equipment.
- The main circuit board should have been configured for 3-phase star use by removing LK2, LK3 and LK6. This is normally factory configured.
- Ensure that the AC supply intended for connection is isolated, locked off and under single operator control. Remove rear cover to leave view shown below.
- Connect as follows:
 - Earth to either earth stud (marked 'E')
 - Phase 1 to AC1, Phase 2 to AC3 and Phase 3 to AC5
 - Neutral to AC2, 4 or 6 (neutral required for star configuration).
- Connect the cables terminated with M4 ring crimps using the M4 x 8 screws (M4 flange nut for earth connection) supplied in the accessory kit.



- The cables should exit through one of the top knockout tabs but if an alternative knockout is to be used ensure additional insulation is used where cabling passes over secondary parts. Cables should be routed close to the top of the shelf using the supplied routing clips (see section 4.4 for further details)
- Refer to section 5 entitled "Commissioning the system" before applying AC power.

4.1.4 3 Phase Delta Supply

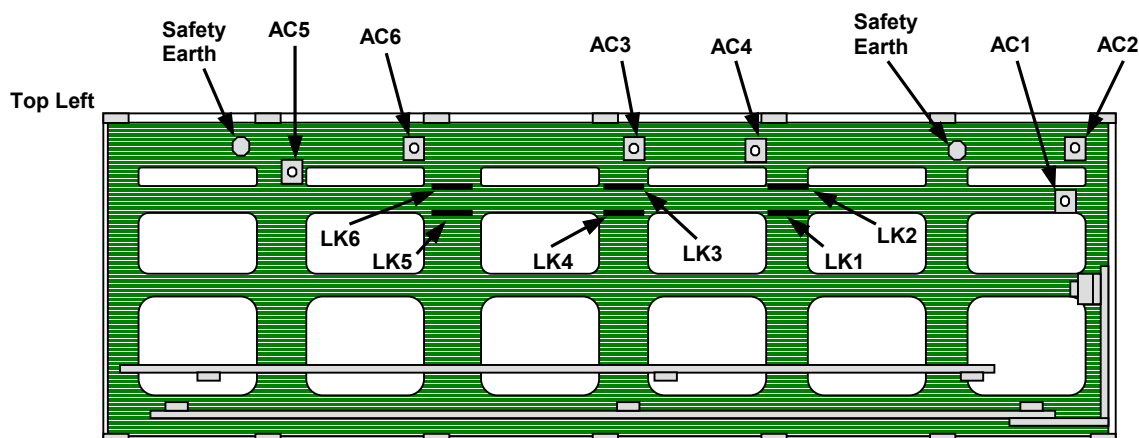
Warning! The DC MX06 60A Shelf can only be used on a **208Vac** phase to phase supply.

In a delta connection system each rectifier input is connected directly across two phases. Due to the maximum voltage rating of the rectifiers being 264Vac this is the maximum phase-to-phase voltage that can be applied.

The maximum input current per phase on a 208Vac supply is 12.5A. Choose AC Input cabling rated accordingly. The cabling should be colour coded as required for the country/state concerned.

To connect the input supply to the DC MX06 60A Shelf proceed as follows:

- The AC input current to the system should be limited by an appropriate device in the event of a short circuit as defined in **EN60950** to protect the internal wiring of the end use equipment.
- Ensure that the AC supply intended for connection is isolated, locked off and under single operator control.
- The main circuit board should have been factory configured for 3-phase delta prior to sale. LK2, LK3, LK4 and LK5 should be fitted but LK1 and LK6 should be removed. Also an external link should connect AC2 to AC5. This is normally factory configured.
- Connect as follows:
 - Safety earth to either earth stud (connect first)
 - Phase 1 to AC1
 - Phase 2 to AC5
 - Phase 3 to AC4
- Connect the cables terminated with M4 ring crimps using the M4 x 8 screws (M4 flange nut for earth connection) supplied in the accessory kit.



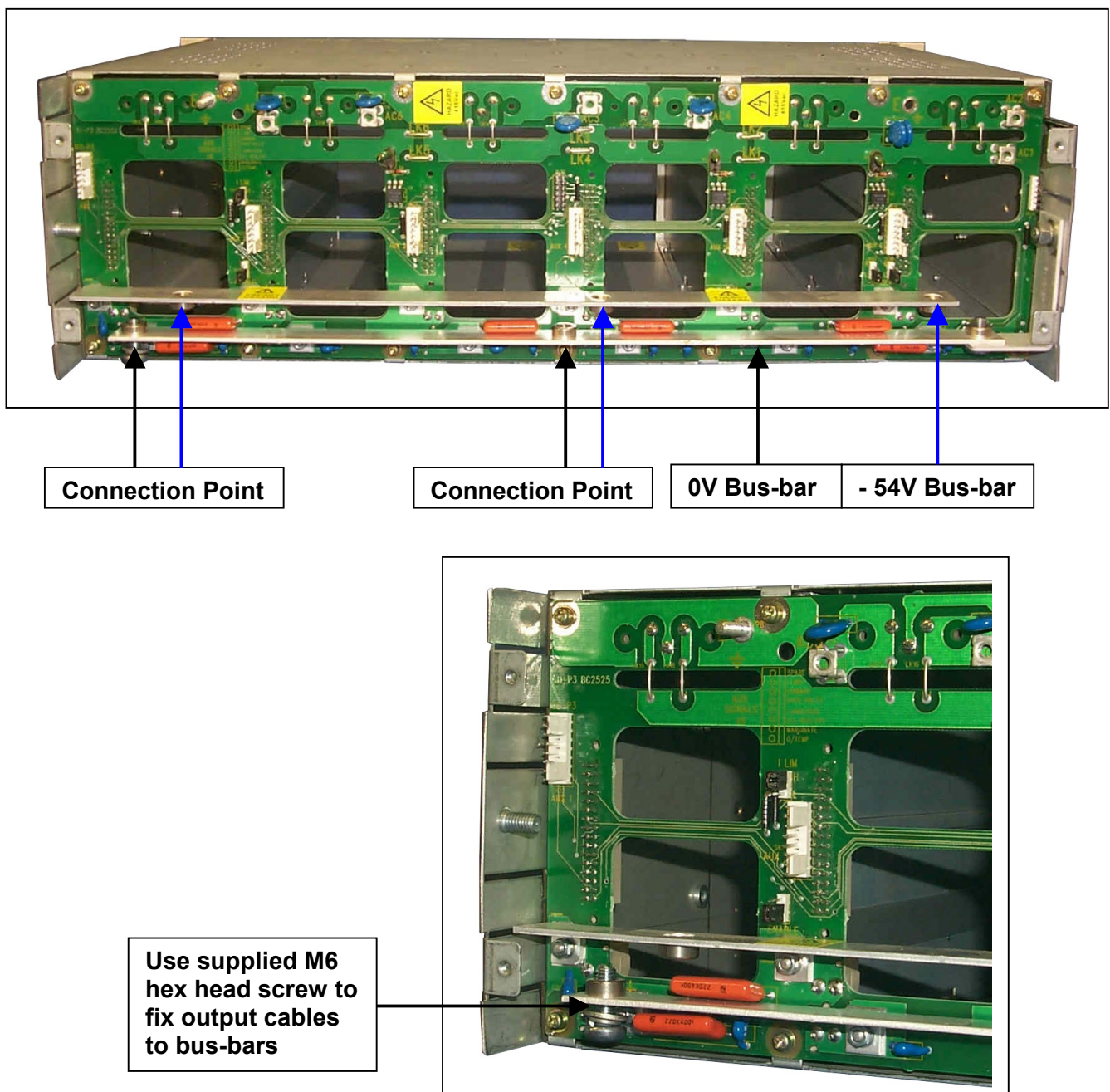
- The cables should exit through one of the top knockout tabs but if an alternative knockout is to be used ensure additional insulation is used where cabling passes over secondary parts. Cables should be routed close to the top of the shelf using the supplied routing clips (see section 4.4 for further details)
- Refer to section 5 entitled "Commissioning the system" before applying AC power.

4.2 System Output Connection

The DC MX06 60A Shelf has an output voltage of 54.5Vdc nominal. In standard configuration the positive output is connected to earth. This means the output is -54.5Vdc with respect to earth.

The picture directly below shows the output bus-bars and the connection points where output cables should be connected. The bus-bar inserts are M6 threaded therefore output cables should be crimped with M6 crimps. The cables should be connected to the bus-bars using the supplied M6 hex head screws with flat and spring washers.

The maximum output current available from the DC MX06 60A Shelf is 63A, cables used should be rated accordingly and colour coded as to meet local installation regulations.



4.3 System Earth

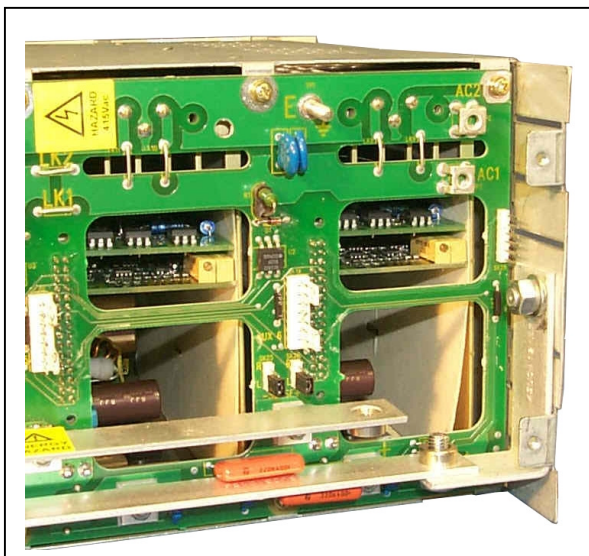
4.3.1 Output Earth

The DC MX06 60A Shelf has its output earthed as default. The output is earthed by a bus-bar, which connects the relevant output bus-bar to the main earth stud. The earth link can be removed to leave the output floating but the user must then earth the output at some other point in the system.

The default configurations are as follows:

Positive earth configuration

Default config for MX06 60A (54V) systems



Negative earth configuration

Default config for MX06 120A (27V) systems



4.3.2 Alarms Card Earth

The alarms card is fixed into position by an M4 screw, which goes through the rear cover and into a fixing on the alarms board. This screw also has the function of earthing the alarms card. This screw must be fitted to ensure optimum EMC performance.



Earth Screw

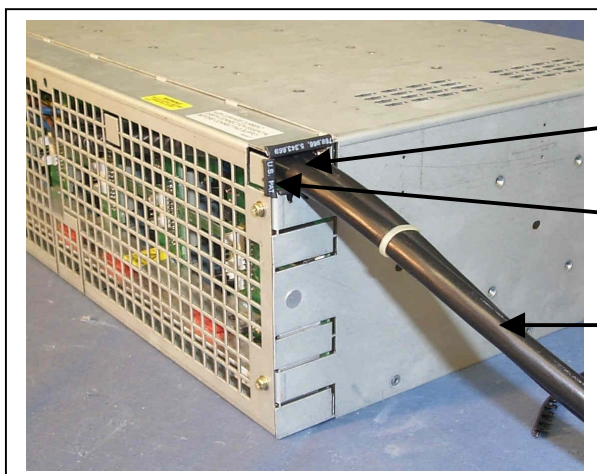
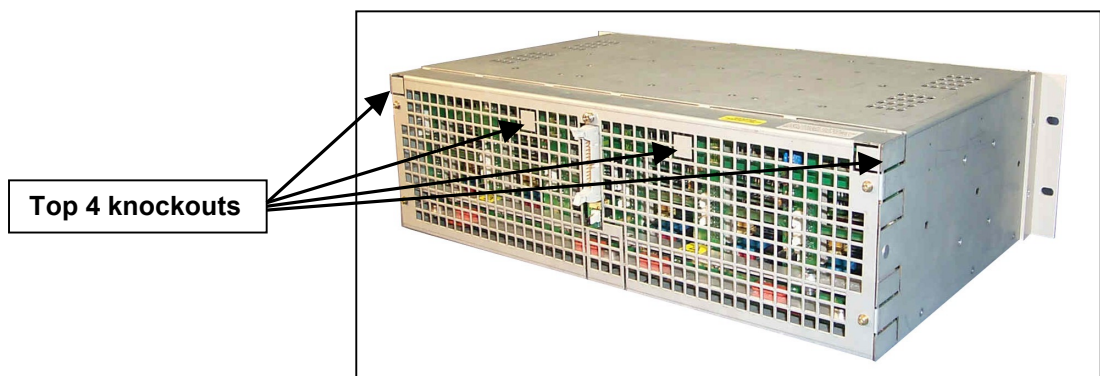
4.4 Routing Of Cables

4.4.1 Input cables

One or more of the top 4 knockouts (top left and right hand side knockouts and 2 actually in the rear cover) must be used for entry of the input AC cable. This is essential if the input cabling used is not double insulated and recommended as this optimises the EMC performance by ensuring the AC Input cables are as far away from the output wiring as possible. Cables should be routed as near the top of the system as possible using the cable clips provided, with big loops of cable inside the shelf being avoided.



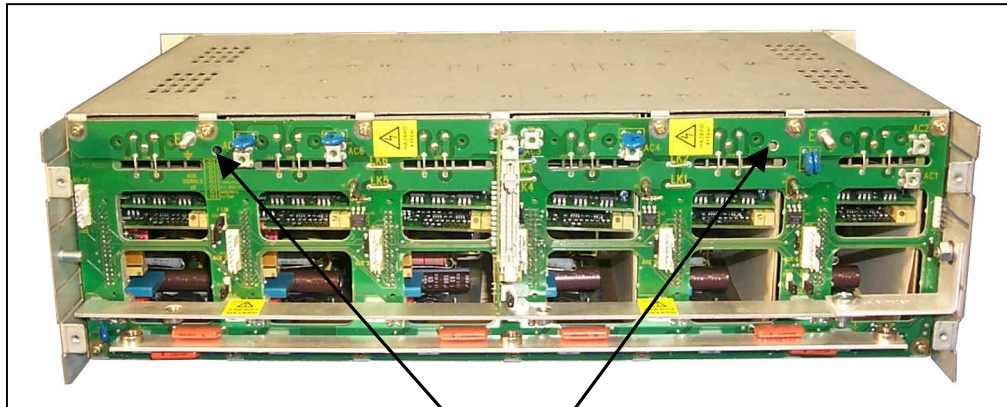
300mm of cable protector grommet strip supplied. Simply cut into required lengths and fit around edge of knockout holes (as shown below)



Removed
Knockout panel

Cable protector
grommet

AC Input Cable



Fit Cable clips in positions shown

4.4.2 Output Cables

The output cables may be of quite large diameter and therefore it may be necessary to use two knockout holes instead of one. The bottom two left hand side knockouts should be used to keep the output cables physically as far from the input cables as possible to optimise EMC performance.

5 Commissioning the System

5.1 General

All site preparation and equipment installation in the previous chapters must be completed before commissioning.

- Ensure that the ac power source isolator is switched OFF.
- Switch any external battery circuit breakers to the OFF position.

5.2 Powering up the DC MX06 60A Shelf

- Switch on the external ac power supply to the DC MX06 60A Shelf.
- Check the Rectifier module LED's:
- If Rectifiers fitted have 4 LED's. Check that each rectifier module has 2 green LED's lit, representing Input Healthy and Output Healthy. There should be no red LED's lit.
- If Rectifiers fitted have a single LED. Check that the red LED of each module is not illuminated as this signifies a "Rectifier Fail"
- Measure the system output voltage using a voltmeter. Check that the output volts are set to the desired level. If the voltage is slightly higher or lower than required simply adjust using the volts adjust potentiometer (see section 2.3.1). **If the output voltage is outside the specified range this may indicate a fault.**
- Switch on any external breakers as required.

6 Manual Handling Procedure

6.1 General

6.1.1 Items within the sub-system present a hazard due to mass. A fully configured system fitted with 6 rectifiers weighs almost 16Kg (35lbs).

6.1.2 The Manual Handling of Loads Regulations, 1993 require that all persons working on the equipment are familiar with the Regulations, that they take care to minimise risk of injury to themselves and others, that they are properly trained, and that the correct equipment is used. Safety shoes are to be worn.

6.1.3 If in doubt about methods, ability to handle the loads, training or equipment, do not proceed without first seeking advice from a competent person.

6.2 Preparation

6.2.1 Before commencing work check the following:

The floor is level, clean, firm and dry.

The working area is clear of obstacles that could obstruct movement or cause tripping.

There is adequate room for the operator(s), equipment and load.

The lighting is sufficient for the load, equipment, loading surfaces, potential hazards and working environment to be seen clearly.

Sound levels are not too high to cause distraction.

6.3 Method

6.3.1 The following is not intended to replace other documents and training courses, only to serve as a guide and checklist. For full guidance refer to the Regulations and supporting documents.

6.3.2 Before lifting, stand as close as possible to the load.

6.3.3 Keep the back straight and as vertical as possible.

6.3.4 Use the leg muscles in preference to the arms.

6.3.5 Minimise twisting, stretching and stooping.

7 Fault Finding / Symptoms

The power system is designed for maximum reliability and therefore faults during normal operation are unlikely. If faulty operation does occur the source of the failure can usually be readily determined by inspection of the LED's and or the system alarms.

7.1 Warnings

POTENTIALLY LETHAL VOLTAGES AND SOURCES OF HIGH ENERGY ARE PRESENT WITHIN THE POWER SYSTEM. EXTREME CAUTION MUST BE OBSERVED AT ALL TIMES. ACCESS TO THE INTERIOR OF THE SYSTEM FOR INSTALLATION, COMMISSIONING, MAINTENANCE AND REMOVAL AND REPLACEMENT PURPOSES IS LIMITED TO FULLY TRAINED SERVICE PERSONNEL ONLY.

RINGS, WATCHES AND JEWELLERY SHOULD BE REMOVED AND ONLY SINGLE ENDED INSULATED TOOLS SHOULD BE USED WHEN WORKING OR MAKING MEASUREMENTS INSIDE THE SYSTEM. A SOLDERING IRON MUST NOT BE USED UNLESS THE INPUT, OUTPUT AND BATTERY (IF CONNECTED) HAVE FIRST BEEN ISOLATED.

7.2 Fault Symptoms

Typical fault symptoms and their possible causes are shown in table below. If the fault cannot be diagnosed contact the manufacturer.

SYMPTOM	POSSIBLE CAUSE(S)
Output voltage is zero at load	1. Failure of AC supply. 2. Failure of external disconnect device.
All Rectifiers Input Healthy LED's are lit but system output voltage is still zero before any disconnection devices.	1. Rectifiers have tripped due to over-voltage. Remove rectifier(s) temporarily (20 seconds) to reset condition 2. System output not enabled, could be set to remote enable instead of local enable. (see section 2.4.2)
One or more rectifiers output healthy LED is extinguished temporarily or Rectifier Fail LED lit temporarily (single LED version).	1. Rectifiers tripping due to over temperature condition, (Local ambient may be above rated level).
One or more rectifiers output healthy LED extinguished permanently or Rectifier Fail LED lit permanently.	1. System in overload condition (check system load or Rectifier current limit LED's if fitted). 2. System tripped due to over-voltage condition (check rectifier over-voltage LED's if fitted).
System not capable of supplying expected current levels.	1. One or more rectifiers have tripped due to over temp condition. 2. System set to current limit "Low" instead of "High" (see section 2.4.1).

8 Service, Accessories & Spares

8.1 Rectifier replacement

If a faulty rectifier is to be replaced simply unscrew the two front panel fixings on the rectifier front panel and withdraw the rectifier from the shelf. A replacement rectifier can then be inserted directly into the shelf and will start-up automatically.

Note – The rectifiers are “hot plugable” and therefore can be replaced without turning the system off.

8.2 Alarms Card replacement

If the alarms card is to be replaced turn off all supplies to the MX06 by operation of the relevant disconnection devices. Then simply unscrew the single earthing screw and the four rear cover screws. Remove the rear cover and then unplug the alarms card. A replacement card can then be inserted directly into the shelf and will start-up automatically when power is reconnected.

Note – The system can be operated without the alarms card but all alarm and control functions will be unavailable.

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